

WHAT IS CLAIMED IS:

1. A method for fabrication of miniature structures, comprising the steps of:

providing a fabrication tool, including:

a substrate having a surface,

an energy beam directed towards said substrate, and

control means operating said fabrication tool in (1) material removal mode of operation and (2) material transfer mode of operation, in a predetermined sequence;

whereby when said fabrication tool is in said material removal mode of operation, further providing a direct access of said energy beam to said surface of said substrate and cleaning said surface of said substrate by changing a relative disposition between said energy beam and said substrate in accordance with a first predetermined pattern.

2. The method of Claim 1, further comprising the steps of:

5 providing a material carrier element having a deposition layer supported thereon and facing said substrate, whereby when said fabrication tool is in said material transfer mode of operation further including positioning said deposition layer in an interception path with said energy beam, and

10 *energy* changing a relative disposition between said ~~energetic~~ beam and said substrate in accordance with said first predetermined pattern, thereby transferring a deposition material contained in said deposition layer on said surface of said substrate at locations thereon cleaned during said material removal mode of operation.

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3. The method of Claim 2, further comprising the steps of:

changing the mode of operation of said fabrication tool to a successive material removal mode of operation following said material transfer mode of operation, and

cleaning the surface of said substrate by changing relative disposition between said energy beam and said substrate in accordance with a second predetermined pattern.

4. The method of Claim 3, wherein said second predetermined pattern differs from said first predetermined pattern.

5. The method of Claim 3, wherein the surface of said substrate has said deposition material deposited thereon.

6. The method of Claim 1, wherein said energy beam includes a laser beam.

5 7. The method of Claim 6, wherein said laser beam includes an ultraviolet laser beam.

10 8. The method of Claim 2, further including the steps of:

displacing said material carrier element away from interception with said energy beam in said material removal mode of operation.

15 9. The method of Claim 2, further including the steps of:

20 maintaining said deposition layer in a position intercepting with said energy beam in said material transfer mode of operation.

10. The method of Claim 3, further including the steps of:

changing the relative disposition between said energetic beam and said substrate by controlling the position of said energy beam relative to said substrate.

11. The method of Claim 3, further including the steps of:

changing the relative disposition between said energy beam and said substrate by controlling the position of said substrate relative to said energy beam.

12. The method of Claim 3, further including the step of:

changing the relative disposition between said energetic beam and said substrate by controlling the positions of said energy beam and said substrate in coordinated fashion.

13. The method of Claim 3, in said "material removal" modes of operation, supplying a carrier gas flowing through said fabrication tool to remove residues formed as the result of said cleaning of said substrate surface.

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14. The method of Claim 3, further including the steps of:

supplying an inert cover gas flowing through said fabrication tool to prevent areas of said substrate surface freshly exposed during said cleaning of said substrate surface from the re-oxidation.

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15. The method of Claim 1, wherein said substrate surface includes at least one material to be removed therefrom, said method further comprising the step of:

adjusting, by means of said control means, intensity of said energy beam for removing said at least one material.

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16. The method of Claim 1, wherein said substrate surface includes a plurality of different materials to be removed therefrom, said method further comprising the steps of:

adjusting, by means of said control means, intensity of said energy beam in accordance with positions of said materials to be removed from said substrate surface.

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17. A method of patterned cleaning of a substrate surface, comprising the steps of:

providing a fabrication tool, including:

a substrate having a surface thereof,

an energy beam directed towards said substrate, and

control means operating said fabrication tool in either a material removal mode of operation and a material transfer mode of operation whereby in said material removal mode of operation further performing a first cleaning of said substrate surface by allowing a direct access for said energy beam to said substrate surface and by changing a relative disposition between said energy beam and said substrate in accordance with a first predetermined pattern, and

performing a second cleaning of said substrate surface by allowing a direct access for said energetic beam to said substrate surface and by changing a relative disposition between said energy beam and said substrate in accordance with a second predetermined pattern.



18. The method of Claim 17, further including the steps of:

providing a material carrier element having a deposition layer supported thereon and facing said substrate,

between said first and second cleaning steps, positioning said material carrier element into interception with said energy beam, thereby translating said fabrication tool into said material transfer mode of operation, and

changing relative disposition between said energetic beam and said substrate in accordance with said first predetermined pattern, thereby depositing a deposition material contained in said deposition layer onto said substrate surface at locations therein cleaned during said first cleaning.

19. The method of Claim 17, wherein said second cleaning is performed on said substrate surface including at least one deposited structure.

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20. An apparatus for patterned cleaning of a substrate surface, comprising:

a substrate having a surface thereof,

an energy beam directed towards said substrate,

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and

control means operating said apparatus in either a material removal mode of operation and material transfer mode of operation,

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in said material removal mode of operation, said control means change the relative disposition between said energy beam and said substrate in accordance with a predetermined pattern, thus cleaning said substrate surface in a patterned fashion.

21. The apparatus of Claim 20, wherein said energy beam includes a laser beam.

5 22. The apparatus of Claim 21, wherein said laser beam includes a pulsed ultraviolet beam.

10 23. The apparatus of Claim 20, wherein said energy beam includes an electron beam.

15 24. The apparatus of Claim 20, wherein said energy beam includes an ion beam.

20 25. The apparatus of Claim 20, further including a material carrier element positionable in interception with said energy beam in said material transfer mode of operation and away from interception with said energetic beam in said material removal mode of operation, said material carrier element including a deposition layer supported thereon and facing said substrate.

26. The apparatus of Claim 20, wherein said control means further includes means for adjusting intensity of said energy beam in accordance with a type of material on said substrate surface.

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27. The apparatus of Claim 21, wherein said substrate surface has a plurality of material disposed thereon, said adjusting means being adapted for adjusting the intensity of said energy beam in accordance with position of each of said plurality of materials.

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28. The apparatus of Claim 20, further including means for supplying a carrier gas flowing through said apparatus for removing therefrom residues formed during said surface cleaning.

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29. The apparatus of Claim 20, further including means for supplying an inert cover gas flowing through said apparatus for preventing reoxidation of areas on said substrate surface freshly exposed during said cleaning.

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30. The apparatus of Claim 20, wherein said control means is operatively coupled to said energy beam to change the position thereof with respect to said substrate.

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31. The apparatus of Claim 20, wherein said control means is operatively coupled to said substrate to change the position thereof with respect to said energy beam.

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32. The apparatus of Claim 25, wherein said control means is operatively coupled to said material carrier element for changing the position thereof, thus setting said apparatus in one of said material removal and said material transfer modes of operation.

33. The apparatus of Claim 20, wherein said control means operates said apparatus in either of said material removal and material transfer modes of operation in a predetermined sequence.